

**ACCEPTABILITY FACTORS OF IRIS-BASED  
AUTHENTICATION APPROACH AMONG NIGERIAN  
USERS OF AUTOMATED TELLER MACHINE**



A thesis submitted to the College of Arts and Sciences in full fulfillment of  
the requirements for the degree of Doctor of Philosophy

By

**JIMOH RASHEED GBENGA**

**UNIVERSITI UTARA MALAYSIA**

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Tandatangan  
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Nama Penyelia/Penyelia-penyelia:  
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## ABSTRAK

Permasalahan sosio-ekonomi semasa di Nigeria telah menyebabkan kadar jenayah pelbagai perkhidmatan berkaitan dengan teknologi maklumat (IT) meningkat. Contohnya, penipuan pengesahan yang melibatkan penggunaan mesin auto teller (ATM) dalam industri perbankan di negara berkenaan. Oleh itu, satu kajian awal untuk mengenal pasti pandangan pengguna awam terhadap pelaksanaan pengesahan nombor identifikasi peribadi (PIN) ATM telah dijalankan terhadap 104 para pengguna ATM di Negeria. Kajian ini mendapati pengguna merasa tidak begitu selamat menggunakan pendekatan pengesahan tersebut dan mereka lebih cenderung kepada penggunaan teknologi biometrik sebagai kaedah pengesahan PIN ATM untuk masa hadapan. Sehubungan dengan hal ini, kajian lampau telah membuktikan pengesahan melalui iris adalah kaedah pengesahan biometrik terbaik berdasarkan kriteria penerimaan dan penolakan. Namun, meskipun ada keperluan untuk menukar kaedah sedia ada kepada kaedah pengesahan biometrik berdasarkan iris, belum ada kajian yang terperinci yang mengkaji penerimaan kaedah tersebut di kalangan pengguna masyarakat awam. Oleh itu, kajian ini bertujuan menentukan faktor-faktor dalam menjelaskan penerimaan pengguna terhadap kaedah pengesahan melalui iris di kalangan masyarakat Nigeria agar pelaksanaan kaedah ini berjaya di masa hadapan. Untuk mencapai tujuan penyelidikan ini, pendekatan kuantitatif digunakan untuk pelaksanaan tinjauan terhadap para pengguna ATM. Selain itu, pendekatan kualitatif juga digunakan untuk pelaksanaan analisis kandungan dan pembentukan kategori pandangan responden. Sejumlah 351 responden telah terlibat dalam kajian ini. Instrumen kajian dibina berdasarkan teori asas *Unified Theory of Acceptance and Use of Technology* (UTAUT) dan juga enam dimensi model Niat Tingkah Laku (*Behavioural Intention*). Kajian ini telah menyumbang kepada teori dan amalan; bagi teori asas UTAUT, hubungan hipotesis antara empat faktor UTAUT (yakni Jangkaan Prestasi, Jangkaan Usaha, Pengaruh Sosial dan Keadaan yang Memudahkan) didapati signifikan dan selanjutnya mengesahkan pelaksanaan pengesahan dimensi-dimensi dalam kajian penerimaan teknologi dan penyebaran untuk masyarakat umum. Kajian ini adalah antara kajian-kajian terawal yang menyelidiki faktor-faktor penerimaan dari pengesahan melalui iris dan juga membuka peluang untuk kajian-kajian seterusnya dalam penggunaan model UTAUT. Impak dari pengembangan model asal UTAUT dengan memasukkan unsur Sikap dan Kegelisahan telah menghasilkan satu pengukuran Niat Tingkah Laku yang lebih baik dalam penggunaan teknologi iris di mana lebih banyak sisihan dapat diperjelaskan berbanding penyelidikan sebelum ini. Seterusnya, kesan moderasi dari aspek jantina dan umur juga diuji di mana tiada dari konstruk-konstruk tersebut telah dipengaruhi oleh faktor jantina dan hanya Jangkaan Usaha dan Kegelisahan telah dipengaruhi oleh faktor umur responden; satu temuan yang berlawanan dengan model asal UTAUT. Temuan ini telah menghasilkan satu cadangan baru terhadap model penerimaan kaedah pengesahan berdasarkan iris untuk penggunaan awam di Nigeria yang diharapkan dapat membantu pihak-pihak terbabit bagi menghasilkan teknologi yang berguna dengan mempertimbangkan semua faktor yang telah dikenal pasti dalam kajian ini.

## ABSTRACT

The present socio-economic problem in Nigeria has increased the crime rate tremendously to the extent that the ubiquitous advantage of Information Technology (IT)-oriented services has been deprived due to the vulnerability; a good example is the alarming automated-teller machine (ATM) fraud in the country. A preliminary study is conducted among 104 Nigerian ATM users purposely to find out their perception on the current Personal Identification Number (PIN) authentication. The findings of the study showed that users are not fully secured using the authentication approach and they prefer biometric technology for the future authentication method. With respect to this, iris-based authentication is proven to be the best biometric authentication due to its best acceptance and rejection criteria. Although, there is a need to migrate to iris-based biometric authentication, there has not been any detailed study to determine its acceptability among users of public zone terminals such as the ATM. Therefore, this study aims at determining the factors that verify users' acceptance of iris-based authentication approach in Nigerian public domains, specifically the ATM, for allowing its successful implementation in the future. In achieving the research aim, quantitative approach was mainly applied to survey the ATM users; while qualitative approach was used to conduct content analysis and categorize respondents' opinions. A total of 351 respondents were involved. A survey instrument is developed based on the underpinning theory Unified Theory of Acceptance and Use of Technology (UTAUT) and also from six dimensions of Behavioural Intention (BI) model. This study contributes to both theory and practice; for the underpinning theory, UTAUT, the hypothesized relationships between four factors of UTAUT (i.e. Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Condition) are all supported which further validates the authenticity of the dimensions in technology acceptance and diffusion research for public domain. This study is among the initiators to investigate the acceptance factors of iris-based authentication and it also opens ways for future researches using the UTAUT model. The impact of the extension performed to the original UTAUT by including Attitude and Anxiety presents a better measure of behavioural intention to use the technology in question by explaining more variance than what is explained without the extension; which is in contrary to the opinions of previous researchers. Furthermore, the moderating effect of gender and age is examined where none of the constructs is influenced by gender and only Effort Expectancy and Anxiety are influenced by age of the respondents in contrary to the original UTAUT model. This led to the final proposed model of acceptance of iris-based authentication method for Nigerian public domains which is expected to assist iris authentication technology companies to come out with a usable iris-based authentication technology having considered all the factors identified in this study.

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## **ABBREVIATIONS**

A:	Attitudes towards use
ANOVA:	Analysis of Variance
ANX:	Anxiety
ATM:	Automated Teller Machine
ATT:	Attitude
BI:	Behavioural Intention
CBN:	Central Bank of Nigeria
C-TAM-TPB:	Combined TAM and TPB
DNA:	Deoxyribonucleic acid
DTPB:	Decomposed TBP
EE:	Effort Expectancy
EFCC:	Economic and Financial Crime Commission
EV:	External Variable
FAR:	False Acceptance Rate
FC:	Facilitating Condition
FRR:	False Rejection Rate
IBIA:	International Biometric Industry Association
ID:	Identity
IDT:	Innovation Diffusion Theory
IT:	Information Technology
KMO:	Kaiser-Meyer-Olkin
MM:	Motivational Model
MOGA:	Multi-Objectives Genetic Algorithm
MPCU:	Model of PC Utilization
PE:	Performance Expectancy
PEOU:	Perceived Ease Of Use
PIN:	Personal Identification Number
PU:	Perceived Usefulness
SCT:	Social Cognitive Theory



SEF:	Self-Efficacy
SI:	Social Influence
SPSS:	Statistical Package for Social Science
TAM:	Technology Acceptance Model
TAM2:	Technology Acceptance Model 2
TPB:	Theory of Planned Behaviour
TRA:	Theory of Reasoned Action
UB:	Use Behaviour
UTAUT:	Unified Theory of Acceptance and Use of Technology

# **CHAPTER 1**

## **BACKGROUND OF THE STUDY**

### **1.1 Introduction**

The world has turned to a global village via Information Technology (IT). This dynamic growing digital world has called for fast responding and reliable security devices. The singular fact is that almost all business data are now being converted into an electronic form which requires us to protect such information from some unethical persons who are always exploring possibilities of gaining illegal access to the information. It has become practically impossible for any organization to succeed without IT (Iloanusi & Osuagwu, 2006). This has brought the need, to migrate from the traditional ways of doing things to an information technology compliant way so as to improve efficiency. The need for IT in almost all organizations cannot be over emphasized. Some estimates indicate that since 1980s, about 50 percent of all new capital investment in organization has been in IT (Suryadi, 2007). Therefore, this chapter discusses research motivation,

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## **Research Publications**

### **A. Journals**

1. **Jimoh, R. G. & Norshuhada, S. (2010b).** Modeling the Factors that influence Behavioural Intention to Use Iris Authentication Approach for Public Authentication among Nigerian Users of Public Terminals, ***African Journal For The Psychological Study of Social Issues (AJPSSI)***, Volume, 13- Accepted, April, 2010. (**SCOPUS Indexed Journal**)
2. **Jimoh, R. G. & Norshuhada, S. (2009c).** The moderating effect of Gender on Behavioural Intention to Use Iris Authentication approach for Public Authentication among Nigerian Users of Public Terminals, ***Journal Sistem Teknik Industri (JSTI), Indonesia***, 10 (3), 918 – 922.

### **B. Proceedings**

3. **Jimoh, R.G. & Norshuhada, S. (2009a).** Evaluating Current Authentication Methods: Prediction of a more suitable Authentication Approach for Public interaction, ***Proceedings of International Conference on Computing and Informatics (ICOCI09)***, 251 – 257.
4. **Jimoh, R. G. & Norshuhada, S. (2009b).** Unified Theory of Acceptance and Use of Technology for measuring the acceptability of iris-based authentication while authenticating user's identity in public places: A review. ***Proceedings of International Soft Science Conference (ISSE09 )***, 487 – 493.
5. **Jimoh, R. G. & Norshuhada, S. (2010a).** The Acceptability of Iris-based Authentication for Public Domain: An Instrumental Design, ***Proceedings of International Knowledge Management Conference (KMICe, 2010)***, 624 - 628.
6. **Jimoh, R. G., Norshuhada, S. & Dalle, J.(2010).** Behavioural Intention to use Iris Authentication Approach for Public Authentication Among Users of Public Terminals: Where doe age come in? – **Accepted for International Conference on Industrial Engineering and Business Management (ICIEBM) 2010.**
7. **Jimoh, R. G., Norshuhada, S. (2010).** The Alarming ATM fraud in Nigeria:iris Authentication an alternative to the knowledge/token-based Authentication Method, ***Accepted for African Development Conference, October, 2010*** at Institute of African studies, Rabat, Morocco.